Tornado Vortex Signature Rapid Update Product 7/1/03 RPG Build 5

***Redline change to* ICD for Product Specification 2620003**

Modified product:

21 TORNADO VORTEX SIGNATURE (TVS, TRU)

21.1 SSS Product Description

"This product shall provide information regarding the existence and location of an identified Tornado Vortex Signature (TVS). This product shall be produced from the output of the Tornado Detection Algorithm. The product shall produce an alphanumeric tabular display and a graphic overlay of the algorithm output data for each identified TVS (and Elevated TVS (ETVS)) signature information when such is identified. This product shall be updated once per volume scan time. This product shall include annotations for the product name, radar ID, time and date of volume scan, radar position, radar elevation above MSL, and radar operational mode. Upon user request, all site adaptable parameters identified as inputs to the algorithm(s) used to generate data for this product shall be available at the alphanumeric display."

"A Tornado Vortex Signature Rapid Update (TRU) version of this product shall be generated once per elevation scan time to provide updated Tornado Detection Algorithm (TDA) information. Current Tornado Detection Algorithm data at an elevation scan shall be based on the elevations that have been completed thus far in the current volume scan. This information shall be combined with TDA, MDA, and Storm Track Algorithm information from the previous volume scan to form the TRU product. The average motion of all tracked MDA features from the previous volume scan shall be used to derive a forecast position of each TDA feature from the previous volume scan at the current volume scan time. If the average motion from MDA is unavailable, the average motion of all SCIT storm cells from the previous volume scan shall be used. In priority rank order, the forecast position of each feature from the previous volume scan shall be matched to the closest feature from the current volume scan, within a search radius defined by SCIT algorithm adaptation data. Priority rank order places TVS types before ETVSs, and within each type features are ordered by Low-level Delta Velocity, from greatest to least. Current TVS/ETVS features which are not matched to a feature from the previous volume scan, shall be assigned the status of New. If previous volume scan data are unavailable, all features shall be reported as New. Current features shall inherit the attributes of the matched previous feature (associated storm ID, feature type, low-level delta velocity, maximum delta velocity and its height, average delta velocity, maximum shear and its height, base and top heights, depth, and base azimuth and range). The position attributes (base azimuth, range, and height) of a previous feature matched to a current feature shall be updated to the current detection. The position attributes of a previous feature not matched to a current feature, shall be set to the extrapolated forecast position (base azimuth and range only). The status of unmatched previous features shall be assigned to Extrapolated. Strength attributes of a previous feature matched to a current feature shall be updated if they increase in magnitude. The strength attributes are feature type, low-level delta velocity, and depth. The attributes maximum delta velocity, maximum shear, and average delta velocity are also updated to the current value if they increase in magnitude, but their increase will not trigger a status change to Increasing. If the maximum delta velocity and maximum shear are updated, their heights shall also be updated. Features with increasing strength attributes shall be assigned the status of Increasing. All other matched features shall be assigned the status of Persistent. Attribute data updated from current volume data shall be identified. At the end of the volume scan, the extrapolated features shall be removed. This product shall be generated in a format that can be used to generate an alphanumeric tabular display, a graphic display or a graphic overlay to other products. In each type of display, features shall appear in priority rank order. On alphanumeric displays, the status (Persistent, Increasing, New, or Extrapolated) of each feature status shall be reported. In the graphic symbol display, features status shall be reported as either extrapolated or current. Current features

include all features with a status of Increasing, Persistent, or New. If on a particular elevation scan there is no output (i.e., no features of any type are identified), a version of the product shall be produced that exhibits the negative condition. This product shall include annotations for the product name, radar ID, date and time of volume scan, elevation angle, radar position, radar elevation above MSL, and radar operational mode."

NOTE: ONLY EXCERPTS OF CHANGED TEXT FOLLOWS

21.2 Display Format

Each TVS (and ETVS) is associated with the nearest storm cell within an UCP adaptable distance. If the TVS (or ETVS) is not associated with a storm cell, "??" will be displayed as the Storm Cell ID.

With the following exceptions, the format of the TRU graphic attribute and alphanumeric tabular portions of the product will follow the non-rapid update TVS product: feature status will be reported as EXT, PER, INC, and, NEW to denote extrapolated, persistent, increasing, and new features, respectively; and the character ^ (hexadecimal value 5E) will be placed next to data which was computed from current volume scan detections. The format to be used is defined in Appendix B and C.

21.2.1.1 Geographic

The graphic display consists of the TVS and ETVS symbols (see Section 21.3.2) The symbols are placed such that the apex of the triangle is centered on the geographic position of the TVS (or ETVS) at the lowest elevation angle where it is found. For the TRU product: extrapolated TVS and ETVS features will be displayed centered on the forecasted position at the lowest elevation scan it was previously detected; TVS and ETVS features detected in the current volume scan will be displayed centered on the position of the matched current feature at the lowest angle in which it is detected The symbols flash when displayed as an overlay. The operator will have the option to stop the flashing. Along with each TVS (and ETVS), the Storm Cell ID (see Section 18.2) is displayed in white (Code: FF FF FF) 5 pixels to the right and 5 pixels down from the location of the storm cell centroid. This part of the product is displayable in full- and quarter-screen formats (see Appendix B).

The PUP operator will have the ability through a one level password protected menu at the Alphanumeric Terminal to select whether to display the symbols for only TVSs or both TVSs and ETVSs. The default will be to only display TVS symbols. For the TRU version on the AWIPS the following applies: the operator will have the option to turn off display of extrapolated features; the operator will be provided the option to choose between displaying the latest elevation (i.e., highest elevation) or displaying a specific elevation; when the latest elevation is selected, the display will automatically update when higher elevation products are received.

21.2.2 Alphanumeric Screen

TVSs are listed before ETVSs, and both types are ranked by their Low-level Delta Velocity (from greatest to least). (NOTE: If the base or top are detected on the lowest or highest elevation scan of the volume scan, respectively, then the Base/Top (height(s)) is qualified with '<' or '>', respectively. And, if either the base or top are detected on the lowest or highest elevation scan of the volume scan, then the Depth is also qualified with a '>'.) In addition, this part of the TVS product includes all TDA adaptable parameters. The adaptable parameters are formatted in a tabular layout showing the parameter name in one column and the value and units in an adjacent column.

21.3.1 Graphic Screen

Standard Annotations (Appendix A,I(A))
Number of TVSs and ETVSs
Elevation angle for the TRU version

21.3.2 Alphanumeric Screen
Product Specification
Standard Units and Abbreviations,
Product Name
Date/time of volume scan
RDA ID
Elevation angle for the TRU version
Number of TVSs and ETVSs

21.4 Special Symbols
The symbol for a TVS is a red (code: FF 00 00) filled inverted isosceles triangle, and the symbol for an ETVS is the same except it is unfilled (i.e. only a red triangle outline). The triangle has a base of 10 pixels and a height of 14 pixels. For the TRU version on the AWIPS, extrapolated (unmatched) TVS and ETVS features will be distinguished (less prominent symbols) from current (new, persistent, and increasing) features (normal TVS and ETVS symbols).

APPENDIX A - Annotations, Symbols, Abbreviations, and Display Features

(B) Special Symbols and Characters

(7) TVS
The TVS symbol is an inverted red-filled isosceles triangle, and the symbol for an Elevated TVS (ETVS) is the same except it is unfilled. The triangle has a base of 7 pixels and a height of 12 pixels. See section 21.4 for TRU special symbol product requirements.

II. Standard and Product Specific Annotation Display

(4) Display of Storm Attribute Data

Configuration 3 is applied to the TVS product, which is a stand alone product and overlay or annotation to other products. For each TVS and Elevated TVS (ETVS) the following attributes are listed: type (TVS or ETVS), storm cell ID, (base) position (AZ/RAN), average delta velocity, low-level (base) delta velocity, maximum delta velocity, base height, and depth. (NOTE: If the base is detected on the lowest elevation scan of the volume scan, then the base (height) is qualified with '<' respectively. And, if either the base or top are detected on the lowest or highest elevation scan of the volume scan, then the depth is also qualified with a '>'.) The table outline for the TVS attribute data shall be red. Configuration 3B, associated with the TVS Rapid Update (TRU) product closely follows the TVS product. Differences are described in section 21.2 and 21.2.1.1. The manner in which the configuration data and the image data are handled when overlaid on other products (including other overlay products) is the same as that of Configurations l and 2.

TABLE III. STANDARD ABBREVIATIONS

SS Products	Abbreviations
Tornado Vortex Signature Rapid Update	TRU

APPENDIX A - Annotations, Symbols, Abbreviations, and Display Features

(Add any new special symbols.)

APPENDIX B - Graphic Display Formats

CONF 3B

TYPE STID	XXXX ^ XX	
AZ RAN	XXX ^XXX	
LLDV MDV	^XXX ^XXX	
STA AVGDV	XXX ^XXX	
BASE DPTH	<XX.X^>XX	

NTR 21 TVS
TYPES ARE 1. TVS
2. ETVS (Elevated TVS)
NOTE: TVSs are listed before ETVSs, and both type
ordered by Low-level Delta Velocity (from highest tc

APPENDIX C - Alphanumeric Tabular Formats

Format IVb. TVS Rapid Update

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                                    TVS Rapid Update
   RADAR ID: nnn  DATE: mm/dd/yy  TIME: hh:mm:ss  TVS/ETVS: >xx/>xx  ELEV: xx.x

  FEATURE    STORM  AZ/RAN  AVGDV  LLDV  MXDV/Hgt  Depth   Base/Top     MXSHR/Hgt
 STAT TYPE    ID   (deg,nm)  (kt)  (kt)  (kt,kft)  (kft)    (kft)     (E-3/s,kft)

 XXX   TVS^   XX  XXX/XXX^  XXX   XXX^  XXX/XX.X^ >XX.X  <XX.X/>XX.X^  XXX/XX.X^
 XXX   TVS^   XX  XXX/XXX^  XXX   XXX^  XXX/XX.X^ >XX.X  <XX.X/>XX.X^  XXX/XX.X^
 XXX   TVS^   XX  XXX/XXX^  XXX   XXX^  XXX/XX.X^ >XX.X  <XX.X/>XX.X^  XXX/XX.X^
 XXX   TVS^   XX  XXX/XXX^  XXX   XXX^  XXX/XX.X^ >XX.X  <XX.X/>XX.X^  XXX/XX.X^
 XXX  ETVS^   XX  XXX/XXX^  XXX   XXX^  XXX/XX.X^ >XX.X  <XX.X/>XX.X^  XXX/XX.X^
 XXX  ETVS^   XX  XXX/XXX^  XXX   XXX^  XXX/XX.X^ >XX.X  <XX.X/>XX.X^  XXX/XX.X^
 XXX  ETVS^   XX  XXX/XXX^  XXX   XXX^  XXX/XX.X^ >XX.X  <XX.X/>XX.X^  XXX/XX.X^
 XXX  ETVS^   XX  XXX/XXX^  XXX   XXX^  XXX/XX.X^ >XX.X  <XX.X/>XX.X^  XXX/XX.X^
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Redline changes to ICD for RPG to Class I User 2620001

Graphic Information Block:

3.2.1.3 Graphic Alphanumeric Block

Product Code	Product Name
143	Tornado Vortex Signature Rapid Update

Table VII. Product Dependent Definition for Graphic Alphanumeric Block

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY/ PRECISION	REMARKS
Tornado Vortex Signature Rapid Update	Feature Type	Alphanumeric	TVS or ETVS	N/A	See Note 1
	Storm Cell ID	Alphanumeric	A0 through Z0, then A1 through Z1, then A2,…, Z9, or ?? is displayed if the TVS feature is not associated with a storm cell.	N/A	The sequence is recycled following Z9 Note 1

	Feature Status	Alphanumeric	New (NEW), Extrapolated (EXT), Persistent (PER), Increasing (INC)	N/A	NEW: Feature is new in this volume scan; EXT: Feature from previous volume scan with extrapolated position; PER: Feature found in both previous and current volume scan; INC: Like PER but with increasing in either LLDV, feature type, or depth.
	Feature Position: • Azimuth • Range	 Degree nmi	 0 to 360 0 to 124	 1 1	See Note 1
	Average Delta Velocity	kts	0 to 494	1	See Note 1
	Low Level (base) Delta Velocity	kts	0 to 494	1	See Note 1
	Maximum Delta Velocity	kts	0 to 494	1	See Note 1
	Base Height	kft	0.0 to 70.0	0.01	If the Base is on the lowest elevation scan, then it is preceded by a "<" in the display. See Note 1

	Depth	kft	0 to 70	1	If the base or top is on the lowest or highest elevation scan, respectively, then the Depth is preceded by a ">" in the display. See Note 1

Note 1: "^" displayed when the attribute(s) is (are) updated to the current detection

Tabular Alphanumeric Block:

3.2.1.4 Tabular Alphanumeric Block

Product Code	Product Name	Block 3 Message Code
143	Tornado Vortex Signature Rapid Update	143

Table VIII. Product Dependent Definition for Tabular Alphanumeric Block

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY/ PRECISION	REMARKS
TornadoVortex Signature Rapid Update (TRU)	Radar ID	N/A	0 to 999	1	
	Volume Scan Start Date	N/A	Months: 1 to 12 Days: 1 to 31 Years: 0 to 99	N/A	
	Volume Scan Start Time	N/A	Hours: 0 to 23 Minutes: 0 to 59 Seconds: 0 to 59	N/A	

	Number of TVSs	N/A	0 to 25	1	If the TRU identifies more than the (adaptable) maximum number of TVSs, then the number will be preceded by a ">"
	Number of ETVSs	N/A	0 to 25	1	If the TRU identifies more than the (adaptable) maximum number of ETVSs, then the number will be preceded by a ">"
	Elevation	degree	-1.0 to 45.0	0.1	
	Feature Status	Alphanumeric	New (NEW), Extrapolated (EXT), Persistent (PER), Increasing (INC)	N/A	NEW: Feature is new in this volume scan; EXT: Feature from previous volume scan with extrapolated position; PER: Feature found in both previous and current volume scan; INC: Like PER but with increasing in either LLDV, feature type, or depth.
	Feature Type	Alphanumeric	TVS or ETVS	N/A	See Note 3

	Storm Cell ID	Alphanumeric	A0 through Z0, then A1 through Z1, then A2....Z9, or ??	N/A	The sequence is recycled following Z9. "??" is displayed if the TVS or ETVS is not associated with a storm cell
	Position: -Azimuth -Range	 Degrees Nmi	 0 to 359 0 to 124	 1 1	See Note 3
	Average Delta Velocity	kts	0 to 494	1	See Note 3
	Low-level (base)Delta Velocity	kts	0 to 494	1	See Note 3
	Maximum Delta Velocity	kts	0 to 494	1	See Note 3
	Height of the Maximum Delta Velocity	kft	0.0 to 70.0	0.1	See Note 3
	Depth	kft	0.0 to 70.0	0.1	If the base or top is on the lowest or highest elevation scan, respectively then the Depth is preceded by a ">" in the display. See Note 3

	Base Height	kft	0 to 70	1	If the base is on the lowest elevation scan, then it is preceded by a "<" in the display. See Note 3
	Top Height	kft	0.0 to 70.0	.1	See Note 3
	Maximum Shear	m/s/km (or E-3/sec)	0 to 999	1	See Note 3
	Height of the Maximum Shear	kft	0.0 to 70.0	0.1	See Note 3

Note 3: "^" displayed when the attribute(s) is (are) updated to the current detection

New product:

Table II. NEXRAD Message Code Definitions

MESSAGE CODE	MESSAGE TYPE	FIGURE

NO CHANGE

Table IIa. Product Dependent Halfword Definitions for Product Request Message

Product Name	Msg Code (s)	Half-Word #	Content	Units (INT*2)	Range	Accuracy/ Precision
Tornado Vortex Signature Rapid Update	143	22	Elevation Angle	Degrees	-1.0 to 45.0	.1, Note 1,9

Table III. Message Codes for Products

CODE	NTR	PRODUCT NAME	RESOLUTION	RANGE	DATA LEVEL	MESSAGE FORMAT

143	21	Tornado Vortex Signature Rapid Update	N/A	124	N/A	Geographic and Non-geographic Alphanumeric

Figure 3-6. Graphic Product Message (Sheet 8) – Note 1

NO CHANGE

Table V. Product Dependent Halfword Definition for Product Description Block

Product Name	Msg Code	Hword#	Content	Units	Range	Accur/Prec
Tornado Vortex Signature Rapid Update	143	30	Elevation angle	degree	-1.0 to +45.0	.1
Tornado Vortex Signature Rapid Update	143	47	Total Number of TVS	N/A	-25 to 25	1, Note 5
Tornado Vortex Signature Rapid Update	143	48	Total Number of ETVS	N/A	-25 to 25	1, Note 5

Table VI. Product Dependent Definition for Product Symbology Block

PRODUCT NAME	CONTENT	UNITS	RANGE	ACCURACY / PRECISION	REMARKS

Table X. Product List Message Parameter Definition

Product Name (see Note 1)	Message Code	Slice	Parameter 1	Parameter 2	Parameter 3	Parameter 4
Tornado Vortex Signature Rapid Update (TRU)	143	Elevation	N/A	N/A	N/A	N/A

Figure 3-14. Special Graphic Symbol Packets

POINT FEATURE

	MSB HALFWORD LSB
	PACKET CODE (= 20)
	LENGTH OF BLOCK (BYTES)
Repeat for each symbol	I POSITION
	J POSITION
	POINT FEATURE TYPE
	POINT FEATURE ATTRIBUTE

FIELD NAME	TYPE	UNITS	RANGE	PRECISION/ACCURACY	REMARK
Packet Code	INT*2	N/A	20	N/A	Packet Type(Note 1)
Length of Block	INT*2	Bytes	8 to 32760	N/A	Number of bytes in block not including self and packet code
I Position	INT*2	Km/4	-2048 to +2047	1	I starting coordinate
J Position	INT*2	Km/4	-2048 to +2047	1	J starting coordinate
Point Feature Type	INT*2	N/A	5 to 8	1	5 = TVS (extrapolated) 6 = ETVS (extrapolated) 7 = TVS (persistent, new, or increasing) 8 = ETVS (persistent, new, or increasing)
Point Feature Attribute	INT*2	N/A	N/A	N/A	Not used